REMARKS/ARGUMENTS

Introduction:

Claims 1, 16, and 20 are amended, and claims 24-29 are newly added. Claims 1-12 and 16-29 are now pending in the application. The amendments to claim 1 were not made for reasons of patentability but to broaden the claim, and claims 16 and 20 were amended to be consistent with claim 1 and correct a typographical error (not for reasons of patentability). Applicant respectfully requests reexamination and reconsideration of the application.

Applicant thanks the Examiner for the courtesy extended to his representatives at the in-person interview last November.

Restriction:

Prosecution of the pending claims was restricted to species A corresponding to Figure 4 on which claims 1-12 and 16-22 are readable and species B corresponding to Figure 6 on which claim 23 is readable. Applicants elect without traverse species A and have canceled nonelected claim 23.

Rejections of Claims:

Claims 1-7, 10, 11, and 16 were rejected under 35 USC 102(b) as anticipated by US Patent No. 4,983,804 to Chan et al. ("Chan"). Applicants respectfully traverse this rejection on the grounds that Chan does not teach or suggest several aspects of claim 1.

Claim 1 requires "permanently chang[ing] a mechanical operating property of the interconnect structure." The process of heating solder to its melting point and then allowing the solder to cool back to room temperature (as disclosed in Chan) does not permanently change a mechanical operating property of the solder. The solder is briefly melted and then quickly re-solidifies. The mechanical operating properties of the solder after it re-solidifies are the same as before it was melted. Because briefly melting solder does not change its mechanical operating properties, Chan fails to anticipate or render obvious claim 1.

Moreover, even assuming solely for the purpose of argument that briefly melting solder changes its mechanical operating properties, Chan still would not meet the requirements of claim 1. This is because claim 1 requires that the oscillating field heat the structure whose mechanical properties are changed. Chan's electromagnetic field does not heat solder 17, 32, 33. Rather,

Chan's electromagnetic field heats sheet 19 of Figure 2 or balls 30, 31 of Figure 4. Solder 17, 32, 33 is heated by conduction of heat from sheet 19 or balls 30, 31. Nothing in Chan teaches or suggests that a property of sheet 19 or balls 30, 31 is changed. Thus, even if briefly melting solder were deemed to change mechanical operating properties of the solder, Chan still would not meet the requirements of claim 1, which requires that the oscillating field heat the structure whose mechanical properties are changed.

In addition, Chan fails to teach or suggestion not "substantially heating the substrate" because Chan allows for substantial heating of the substrate in the vicinity of pads 22, 34, 43. Indeed, in the passage relied on in the Office Action, Chan describes "localized" heating as heating areas of flexible circuit 12 in "the area of the pads 14, 16." (Chan col. 2, lines 46-48.) And a review of Figure 2, which is the figure the passage relied on in the Office Action refers to, illustrates that sheet 19 is located closer to flexible circuit 12 than to solder 17, which means sheet 19 will heat the portions of flexible circuit 12 located below sheet 19 to higher temperatures than solder 17. Chan thus allows for localized heating of portions of the substrate located near the ferromagnetic material heated by induction. In fact, Chan is not concerned with avoiding heating of the substrate but is only concerned with not melting nearby solder joints. Chan thus fails to teach or suggest heating "interconnect structures ***without substantially heating the substrate***" to which the interconnect structures are attached.

For all of the foregoing reasons, Chan does not anticipate or render obvious claim 1.

Claims 2-7, 10, 11, and 16 depend from claim 1 and are therefore also patentable over Chan. Moreover, claims 2-7, 10, 11, and 16 recite additional features not taught or suggested by Chan.

For example, Chan does not disclose heating sheet 19 or balls 30, 31 to temperatures as high as 800°C or 1300°C as recited in claims 5 and 6. In fact, Chan expressly teaches against heating sheet 19 or balls 30, 31 to temperatures above 400°C. (Chan col. 2, lines 62-68 and col. 3, lines 27-35.) Thus, Chan does not anticipate or render obvious claims 5 and 6.

As another example, claim 10 recites "tuning a frequency of the oscillating electromagnetic field to a resonant frequency of a field generator circuit." Nowhere does Chan discuss field generator circuits much less tuning a frequency of the oscillating electromagnetic field to a field generator circuit. Chan thus does not anticipate or render obvious claim 10.

As yet another example, claim 16 states that the mechanical operating property changed

is at least one of greater yield strength, greater resiliency to fatigue, decreased brittleness, or greater hardness. The mere melting and re-solidifying of solder does not change the yield strength, resiliency to fatigue, brittleness, or hardness of solder. Chan therefore does not anticipate or render obvious claim 16.

Claims 1-11, 13-16, and 18-22 were rejected under 35 USC § 103(a) as obvious in view of US Patent No. 6,150,186 to Chen et al. ("Chen") in combination with Chan or US Patent No. 5,418,811 to Ruffini et al. ("Ruffini"). In addition, claim 12 was rejected under 35 USC § 103(a) as obvious in view Chen, Chan, and US Patent No. 5,340,537 to Barrett ("Barrett"), and claim 17 was rejected under 35 USC § 103(a) as obvious in view Chen, Chan, and US Patent No. 5,476,211 to Khandros ("Khandros"). Applicants respectfully traverse these rejections.

As mentioned above, independent claim 1 requires heating "the interconnect structures ***without substantially heating the substrate***" to which the interconnect structures are attached. The Office Action acknowledges that "Chen et al. is silent regarding how the contact is subjected to heat treatment" and therefore does not teach "heating the interconnect structures ***without substantially heating the substrate***." To make up for this deficiency in Chen, the Office Action relies on Chan and Ruffini.

The prior art, however, contains no suggestion or motivation that would lead a person of ordinary skill in the field to utilize Chan's solder melting system or Ruffini's melting system to heat treat Chen's contact structures 212. Indeed, Chen does not provide any teaching or even the slightest hint that base 202 should not be heated or that there is any advantage to not heating base 202 (although claims in Chen may be broad enough to cover not heating the base 202). Thus, there is no motivation in Chen that would lead to heating Chen's contact structures 212 without also heating Chen's substrate 202.

Chan—which discloses a system for melting selected solder joints on an electronics module—likewise lacks a suggestion or motivation that would lead to a combination with Chen. Chan teaches one advantage for the use of his electromagnetic inductive heating system: melting one solder joint on a substrate without melting other solder joints on the substrate. There is no need, however, in Chen to selectively melt solder. Therefore, a person skilled in the field would not have been motivated to utilize Chan's solder melting system to heat Chen's contact structures 212.

Ruffini's system is for disposing of unwanted objects by melting the objects. As shown in Figure 1, objects to be melted are placed in crucible 12. Ruffini would only be useful to Chen if Chen wanted to destroy the base 202 and contact structure 212 by melting them. There is, thus, no suggestion or motivation in Ruffini that would lead a person of ordinary skill in the field to utilize Ruffini's melting system to heat Chen's contacts 212.

Contrary to the assertion in the Office Action, the six advantages of induction heating mentioned in the background section of Ruffini at column 1, lines 37-61 would not motivate use of induction heating to heat Chen's contacts 212 without substantially heating Chen's substrate 202. The first advantage and the third through sixth advantages merely state that induction heating is fast, controllable, easily automated, requires a short start up time, and is clean (e.g., does not give off fumes). None of these advantages would motivate selective heating of Chen's contact structure 212 without substantially heating substrate 202.

Likewise, the second advantage mentioned in Ruffini merely mentions the unremarkable fact that the size and shape of an inductor coil determines the area on an object that will be heated by the coil. The mere fact that the area heated by an inductor coil depends on the shape of the coil would not lead a person skilled in the field to heat only Chen's contact structures 212 without also heating Chen's substrate 202.

Thus, none of Chen, Chan, or Ruffini provides any teaching, suggestion, or motivation that would lead a person to heat only Chen's contact structure 212 without substantially heating Chen's substrate 202. Indeed, the only teaching or suggestion to heat contact structures without heating the substrate to which the contact structures are attached is in Applicant's specification. Thus, the combination of Chen and Chan or Ruffini is based solely on impermissible hindsight and is therefore improper.

The rejection of claim 1 should also be withdrawn on the further grounds that, even if Chan's solder melting system or Ruffini's object melting system were to be combined with Chen as proposed in the Office Action, the combination would not teach all of the requirements of claim 1.

Claim 1 includes "maintaining the contactor in the oscillating electromagnetic field until each of the interconnect structures obtains a defined heat-treatment temperature substantially greater than an ambient temperature for a predetermined period of time sufficient to permanently change a mechanical operating property of the interconnect structure." Chan's solder melting

system is not designed to and, indeed is not able to, provide or maintain heat sufficient "to permanently change a mechanical operating property of the interconnect structure," as required by claim 1. Chan's solder melting system provides a very imprecise temperature (e.g., varying as widely as 200-400°C) for only a very short period of time (e.g., less than 20 seconds). (See Chan col. 2, line 64 through col. 3, line 1.) The solder is temporarily melted but then quickly returns to its original sold state; no permanent change to the mechanical operating properties of the solder occurs. As discussed above, all that Ruffini's system could be used for is to melt Chen's substrate 202 and contact structure 212. Thus, even if Chen were to be combined with Chan or Ruffini, the combination would fail to disclose all of the requirements of claim 1.

For this additional reason, claim 1 is patentable over Chen, Chan, and Ruffini, and the rejection should be withdrawn.

Claims 2-11, 13-16, and 18-22 depend from claim 1 and are therefore patentable for the same reasons as claim 1.

In addition, claims 2-12 and 16-20 recite other features not found in the prior art of record. For example, claim 12 describes the use of a heat-indicating paint on the interconnect structures of claim 1. Barrett is relied on for its general teachings regarding the existence of such heat-indicating paints. Again, however, there is no motivation to combine Barrett with Chen and Chan. In fact, Chan teaches away from the need for any temperature indicating device because, according to the Chan disclosure, Chan's heating device is self regulating and will heat the pads and substrate only to a predetermined temperature. (Chan col. 3, lines 37-31.) Because Chan's heating device is self regulating and heats to a known temperature, there would be no reason to use temperature indicating paints like those disclosed in Barrett.

New claims 24 and 25 recite additional features not taught or suggested by the prior art of record. For example, claim 24 states that the maintaining step of claim 1 does not melt the interconnect structures. As discussed above, both and Chan and Ruffini teach using oscillating fields to melt objects. Indeed, the only change made by Chan's or Ruffini's systems is melting. As another example, claim 25 states that the oscillating field induces electrical currents in the interconnect structures. As discussed above, Chan induces currents not in solder 17, 32, 33 (which the PTO equated with the interconnect structures of claim 1) but in sheet 19 or balls 30, 31.

New Claims 26-29:

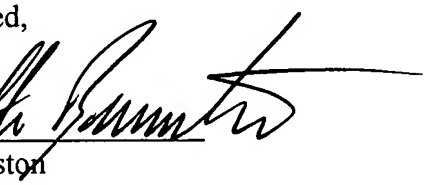
Independent claim 26 is directed to a method in which probes attached to a contactor are heat treated to change at least one mechanical operating property. As was suggested at the interview in November, claim 26 includes a description of the probes, which should distinguish the probes from Chan's balls 30, 31, and claim 26 specifies mechanical operating properties that can be changed. As was also suggested at the interview, dependent claims 27-29 include methods of making the probes. Applicant respectfully submits that new claims 26-29 distinguish over the prior art of record.

Conclusion:

In view of the foregoing, Applicant submits that all objections and rejections are overcome and all of the pending claims are allowable and the application is in condition for allowance. If the Examiner believes that a discussion with Applicant's attorney would be helpful, the Examiner is invited to contact the undersigned at (801) 323-5934.

Respectfully submitted,

Date: January 9, 2006

By 
N. Kenneth Burraston
Reg. No. 39,923

Kirton & McConkie
1800 Eagle Gate Tower
60 East South Temple
P.O. Box 45120
Salt Lake City, Utah 84111-1004
Telephone: (801) 323-5934
Fax: (801) 321-4893